IS 13360 (Part 6/Sec 18) : 2013
ISO 75-3 : 2004

भारतीय मानक

प्लास्टिक — परीक्षण पद्धतियाँ

भाग 6 तापीय गुणधर्म

अनुभाग 18 भार के तहत विक्षेप का तापमान ज्ञात करना — उच्च-सामर्थ्य थर्मोसेटिंग लेमिनेट एवं लाँग-फाइबर-प्रबलित प्लास्टिक

(पहला पुनरीक्षण)

Indian Standard

PLASTICS — METHODS OF TESTING

PART 6 THERMAL PROPERTIES

Section 18 Determination of Temperature of Deflection Under Load — High-Strength Thermosetting Laminates and Long-Fibre-Reinforced Plastics

(First Revision)

ICS 83.080.10;83.120

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Plastics Sectional Committee, PCD 12

NATIONAL FOREWORD

This Indian Standard (Part 6/Sec 18) (First Revision) which is identical with ISO 75-3 : 2004 'Plastics — Determination of temperature of deflection under load — Part 3: High-strength thermosetting laminates and long-fibre-reinforced plastics' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Plastics Sectional Committee and approval of the Petroleum, Coal and Related Products Division Council.

This standard was originally published in 1997 which was identical with ISO 75-3 : 1993. The first revision of this standard has been undertaken to align it with the latest version of ISO 75-3 : 2004.

The text of ISO Standard has been approved as suitable for publication as an Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.
b) Comma (,) has been used as a decimal marker while in Indian Standards, the current practice is to use a point (.) as the decimal marker.

In this adopted standard, reference appears to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their respective places are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 75-1 : 2004 Plastics — Determination of temperature of deflection under load — Part 1: General test method	IS 13360 (Part 6/Sec 3) : 2013 Plastics — Methods of testing: Part 6 Thermal properties, Section 3 Determination of temperature of deflection under load — General test method (*first revision*)	Identical
ISO 178 Plastics — Determination of flexural properties	IS 13360 (Part 5/Sec 7) : 1996 Plastics — Methods of testing: Part 5 Mechanical properties, Section 7 Determination of flexural properties	Identical to ISO 178 : 1993
ISO 295 Plastics — Compression moulding of test specimens of thermosetting materials	IS 13360 (Part 2/Sec 2) : 2012 Plastics — Methods of testing: Part 2 Sampling and preparation of test specimens, Section 2 Compression moulding of test specimens of thermosetting materials (*first revision*)	Identical to ISO 295 : 2004
ISO 2818 Plastics — Preparation of test specimens by machining	IS 13360 (Part 2/Sec 4) : 1999 Plastics — Methods of testing: Part 2 Sampling and preparation of test specimens, Section 4 Preparation of test specimens by machining	Identical to ISO 2818 :1994

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Indian Standard
PLASTICS — METHODS OF TESTING
PART 6 THERMAL PROPERTIES
Section 18 Determination of Temperature of Deflection Under Load — High-Strength Thermosetting Laminates and Long-Fibre-Reinforced Plastics
(First Revision)

1 Scope

This part of ISO 75 specifies a method for the determination of the temperature of deflection under load of high-strength thermosetting laminates and compression-moulded long-fibre-reinforced plastics in which the fibre length is greater than 7,5 mm. The flexural stress used is not fixed, as in ISO 75-2, but is a fraction (1/1 000) of the initial (room-temperature) flexural modulus of the material under test. This allows the method to be applied to materials with a wide range of flexural moduli.

For additional information, see ISO 75-1:2004, clause 1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 75-1:2004, *Plastics — Determination of temperature of deflection under load — Part 1: General test method*

ISO 178, *Plastics — Determination of flexural properties*

ISO 295, *Plastics — Compression moulding of test specimens of thermosetting materials*

ISO 1268 (all parts), *Fibre-reinforced plastics — Methods of producing test plates*

ISO 2818, *Plastics — Preparation of test specimens by machining*

ISO 10724-1, *Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1: General principles and moulding of multipurpose test specimens*

ISO 14125, *Fibre-reinforced plastic composites — Determination of flexural properties*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 75-1 apply.

4 Principle

See ISO 75-1:2004, clause 4.

5 Apparatus

5.1 Means of producing a flexural stress

See ISO 75-1:2004, subclause 5.1.

The span (distance between the lines of contact between specimen and supports) shall be ($30h \pm 1$) mm, where h is the thickness, in millimetres, of the specimen.

5.2 Heating equipment

See ISO 75-1:2004, subclause 5.2.

5.3 Weights

See ISO 75-1:2004, subclause 5.3.

5.4 Temperature-measuring instrument

See ISO 75-1:2004, subclause 5.4.

5.5 Deflection-measuring instrument

See ISO 75-1:2004, subclause 5.5.

6 Test specimens

6.1 General

See ISO 75-1:2004, subclause 6.1.

6.2 Shape and dimensions

See ISO 75-1:2004, subclause 6.2.

The test specimen shall have the following dimensions:

length l:	at least 10 mm longer than the span;
width b:	9,8 mm to 12,8 mm;
thickness h:	2,0 mm to 7,0 mm.

6.3 Specimen inspection

See ISO 75-1:2004, subclause 6.3.

6.4 Number of test specimens

See ISO 75-1:2004, subclause 6.4.

6.5 Test-specimen preparation

Test specimens shall be produced in accordance with ISO 295, ISO 10724-1 or the relevant part of ISO 1268 (and ISO 2818, if applicable), or as agreed by the interested parties.

Ensure that all cut surfaces are as smooth as possible, and that any unavoidable machining marks are in the lengthwise direction.

In the case of compression-moulded test specimens, the width shall be perpendicular to the direction of the moulding force. For materials in sheet form, the thickness of the test specimens (i.e. the thickness of the sheet) shall be in the range 2 mm to 7 mm. For samples over 7 mm thick, reduce the thickness to 7 mm by machining one face. If the faces of the test specimen are dissimilar, report the face machined in the test report.

In view of the requirement for the span to be 30 times the test-specimen thickness (see 5.1), it may be anywhere between 60 mm and 210 mm. Some test machines have a fixed span of 100 mm, however, and can therefore only be used with test specimens up to 3 mm thick. Such a machine may be used but, if the test-specimen thickness is greater than 3 mm, it will have to be reduced by machining. As before, machine only one face and, if the faces are dissimilar, report which face was machined in the test report.

NOTE Most reinforced-thermoset laminates are anisotropic, and may be non-homogeneous across their thickness, and machining may significantly alter their properties.

6.6 Annealing

Discrepancies in test results due to variations in moulding conditions can be minimized by annealing the test specimens before testing them. Since different materials require different annealing conditions, annealing procedures shall be employed only if required by the materials standard or if agreed upon by the interested parties.

7 Conditioning

See ISO 75-1:2004, clause 7.

8 Procedure

8.1 Calculation of force to be applied

See ISO 75-1:2004, subclause 8.1.

The force applied shall be such as to generate a flexural stress σ_f equal to 1/1 000 of the flexural modulus of the material at room temperature (either determine the flexural modulus in accordance with ISO 178 or ISO 14125, as appropriate, or use the value given by the manufacturer).

The applied force can also be determined as the force required to generate an initial deflection equivalent to a flexural-strain increase $\Delta\varepsilon_f$ of 0,1 % in the test specimen [see ISO 75-1:2004, equation (5)]. This approach has the advantage of not requiring explicit knowledge of the flexural modulus to determine the force to be applied. If this approach is used, the initial deflection shall be accurate to ± 2,5 %. Inserting the flexural-strain increase $\Delta\varepsilon_f$ of 0,1 and the required span L of $30h$ in equation (5) in ISO 75-1:2004, it can be seen that the acceptable error in the initial deflection is therefore $\pm (3{,}75 \times 10^{-3})h$.

NOTE For a specimen thickness h of 4 mm, this corresponds to an acceptable error of ± 0,015 mm.

8.2 Initial temperature of the heating equipment

See ISO 75-1:2004, subclause 8.2.

8.3 Measurement

See ISO 75-1:2004, subclause 8.3.

Adjust the span L between the supports to 30 times the thickness h (± 1 mm) of the test specimen. Place the test specimen on the supports in the flatwise position. Apply the calculated force (see 8.1) to give the required flexural stress.

Calculate the standard deflection Δs by means of equation (5) in ISO 75-1:2004, using a value of 0,2 % for the flexural-strain increase $\Delta \varepsilon_f$.

Record the temperature at which the initial deflection of the bar has increased by the standard deflection. This temperature is the temperature of deflection under load. If the individual results differ by more than 5 °C, repeat tests shall be carried out.

9 Expression of results

See ISO 75-1:2004, clause 9.

10 Precision

See ISO 75-1:2004, clause 10.

11 Test report

See ISO 75-1:2004, clause 11, omitting item h).

Amend item i) as follows:

i) the flexural stress used, indicating in addition whether

  — the initial (room-temperature) flexural modulus

  or

  — the initial deflection corresponding to a flexural-strain difference of 0,1 %

  was used;

Include the following additional information:

l) the face machined, if it was necessary to reduce the test-specimen thickness by machining.

Bibliography

[1] ISO 10350-1:1998, *Plastics — Acquisition and presentation of comparable single-point data — Part 1: Moulding materials*

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The technical committee has reviewed the provisions of the following International Standards referred in this adopted standard and has decided that they are acceptable for use in conjunction with this standard:

International Standard	*Title*
ISO 1268 (All parts)	Fibre-reinforced plastics — Methods of producing test plates
ISO 10724-1	Plastics — Injection moulding of test specimens of thermosetting powder moulding compounds (PMCs) — Part 1: General principles and moulding of multipurpose test specimens
ISO 14125	Fibre-reinforced plastic composites — Determination of flexural properties

For tropical countries like India, the standard temperature and the relative humidity shall be taken as 27 ± 2°C and 65 ± 5 percent, respectively.

In reporting the result of a test or analysis made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’.

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards: Monthly Additions'.

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Amendments Issued Since Publication

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